The conference expressed the hope that the meteorological services of these five countries would be able to undertake the services mentioned in the interest of meteorology in the Northern Hemisphere.

For several years past the United States Weather Bureau has been doing what was allocated to this country in the form of the so-called Angot broadcasts at 11 a. m. and p. m., E. S. T. Therefore, no material change in its program will be necessary. France has been transmitting for the benefit of services on this side of the Atlantic a bulletin (once daily) containing European reports. When the suggestions of the conference are complied with, England will take over the duty of transmitting European reports to America, relieving France of the obligation. These arrangements are now under way and it is expected that they will be put into effect within a few months.

In all, there were 109 resolutions adopted at the Copenhagen conference, covering a wide range of activities. All are important, but it has been practicable to refer only to a few which appear to have the most direct bearing on our own activities.

The by-laws or operating rules of the International Meteorological Organization were changed in several important respects. Some of the principal changes are:

Provision for a permanent secretary whose salary will be paid from contributions by the various services.

Provision whereby a director who is unable to attend a called meeting of directors may name a representative, but such representative must be an official of the service that he represents or else a former director thereof.

Location of the permanent headquarters of the secretary in Switzerland after the ensuring 6 years, the office to remain in Holland until that time.

The creation of an executive council of 5 to handle administrative details of the organization in place of the former cumbersome method of referring questions to the International Meteorological Committee (about 20 members) scattered in all parts of the world. The executive council appoints the personnel of the Secretariat and controls its budget and activities. The Chief of the United States Weather Bureau has been elected a member of this council.

NOTES, ABSTRACTS, AND REVIEWS

Weather forecasting from Synoptic Charts by Alfred J. Henry.—The present is the second in the series of Weather Bureau publications on this subject. The first one, Weather Forecasting in the United States, issued in 1916, is out of print. The method of treatment in the present work differs somewhat from that followed in the first of the series. The subject, as every one knows, is difficult of treatment because of the limitations in size and the number of the charts that may be reproduced. The first work contained about 160 charts, the second has but 23 but with these last-named are presented the daily forecasts for each State in the Union together with a statement of the guiding principle, or principles, in mind in each case. No doubt the average reader would like to have had these principles developed at greater length, but to have done so would have made the publication interminably long and wearisome in the reading. The aim has been to give just enough of a suggestion for the groundwork of the forecast to excite the curiosity of the reader for more, in the belief that it is only by intensive study of the problem that a clear understanding will be reached.

There is included in the publication a brief history of the beginnings of weather forecasting in this country, thus filling a gap in the history of the Federal Weather Service that would be difficult to supply in future years.

The publication the full title of which is Miscellaneous Publication No. 71, U. S. Dept. Agri., can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 20 cents the copy.—*A. J. H.*

P. R. Gast on a Thermoelectric Radiometer for Silvical Research,[1] *review by H. H. Kimball.*—The author lays down the following requirements:

1. It should be sensitive to radiation between the limits λ 0.29μ to 2.5μ, which embraces practically the entire wave-length range of energy received at the surface of the earth from the sun.
2. It should be capable of measuring radiation intensitives over the wide range from the lowest intensities in the forest to full sunlight.
3. The sensitivity must be inherent in the instrument, which must be fully and equally sensitive to rays coming from all directions, or it must be possible to amplify the registration.
4. It must be nonselective for different wave lengths.
5. The readings of the instrument must be capable of being expressed in terms of fundamental units of measure, such as gram-calories per unit of area and time.
6. It must be possible to use the radiometer with a recorder of simple and rugged construction.

After trying out 11 devices using different types of receivers and methods of temperature measurements, it was decided to use the nonselective heating method and to register the temperature changes by means of thermoelectric effects. The spherical hot-junction thermopile was found best adapted to the requirements specified in paragraphs 1 to 6, above.

In the illustrations of this thermopile, given in the paper, there are five spherical hot junctions consisting of nickel-silver beads 0.1 inch in diameter to which constantan and iron wires are spot welded. The cold junctions are disks of pure nickel 0.2 inch in diameter and 0.02 inch thick to which the thermocouple wires are also spot welded. The cold junctions are shielded by mounting them between annular shields of mica, which are blackened on their inner surfaces but bright (or white) on their outer surfaces. The hot junctions are coated with lampblack. The thermopile is then mounted on the stem of an electric lamp, baked in an electric oven, and sealed in an evacuated electric-lamp bulb. Thus mounted the iron wire does not rust, and the durability and sensitiveness of the thermopile is greatly increased.

It was customary in field work to connect three of these thermopiles in series at each point where measurements were desired and connect them with a recording galvanometer capable of recording the indications for four different points or stations on one record sheet.

Discussing the thermopile data for the year 1925, the author remarks:

> In the first place it may be noted that the maximum total daily values are obtained in July and August. This is not in accord with the calculations of Kimball (1919) whose data indicate the probability of maxima in May and June. The explanation of the difference is apparently due to Kimball's use of vapor pressure

[1] A Thermoelectric Radiometer for Silvical Research, by P. R. Gast. Harvard Forest Bull. No. 14. 76 pp. 25 figs. Harvard Forest, Petersham, Mass. 1930.

and not relative humidity in determining the probable transmission of the atmosphere. The use of vapor pressure as a criterion predicts the probability of clear skies; the use of relative humidity predicts the probable duration of cloudy weather and the probable radiation absorption in the clouds. A study of the data presented by Piipo (1928) confirms this analysis.

If the author will consult graphs in Figures 1 and 2, pages 157 and 158, Monthly Weather Review, April, 1927, which are based on records by automatic instruments at widely scattered stations, I think he will be convinced that as a rule the maximum daily totals of solar radiation received on a horizontal surface in the open occur in June. This is a rule to which there are exceptions, and does not necessarily apply to measurements made with the spherical hot-junction pyrheliometer under the forest canopy.

The results of this important study are summarized in the author's conclusions which follow:

It appears that there has been a sound physical reason for empirical attempts to develop scales of tolerance. While "light" has for many years been stressed as the important factor in silvicultural operations, looking to the regeneration of the forest, the recent decade has seen the pendulum swing far in the other direction. Foresters in the United States have tended to minimize the importance of radiation.

This tendency was doubtless because most of the intensive fundamental research has been in regions where the small yearly precipitation or the low summer rainfall pointed to available soil moisture as the limiting factor (Bates and Zon, 1922).

But where rainfall is well distributed and on the less meager soils in New England, it is possible to overemphasize the importance of soil moisture in the growth and development of trees. Several years' observations with an apparatus which gives a truer record of the total radiation than any previously used show that over and above the deviations in growth which are due to seasonal water supply the relation of growth to total radiant energy remains constant and conspicuous.

Therefore the attempt to develop successful methods of controlling natural reproduction must continue primarily to consider the reaction of germination, growth, and development to the total radiation that reaches the forest floor.

Dr. Felix M. Exner, 1876–1930.—In the peaceful passing of Doctor Exner on the morning of February 7 there was lost to meteorology one of its most distinguished investigators, to German meteorologists a highly honored colleague, and to a narrower circle a most sincere friend. Intimate friends had sorrowful knowledge that a physical ailment was slowly sapping his health, but none was prepared for a departure so sudden.

The end came in his beloved Vienna where he spent almost all of his life of 54 years. Here he completed grammar school, began and ended his university studies, and entered (1900) as assistant in the *Zentralanstalt für Meteorologie und Geodynamik*, to whose directorship he was named (1917) as successor to W. Trabert.

Doctor Exner's scientific activity was intimately connected with the development of modern meteorology. He was a self-taught meteorologist, in the sense that his university studies dealt exclusively with mathematics and physics. Since he did not avail himself of the teaching of Hann and Pernter it is to be concluded that he had no inner urge toward meteorology, but rather felt that a young physicist well grounded in mathematics would find in meteorology a wide field for activity.

Doctor Hann was probably amazed at this new meteorologist who was unacquainted with the simplest meteorological facts, but Exner demonstrated what may be accomplished when one well qualified in mathematics and physics enters the field of meteorology.

At first he did not feel entirely at home in the scientific atmosphere of the office; Hann's ideas ran along economic and statistical lines and Margules was given to extremely strict theoretical treatment of problems whose significance could not be apprehended by a meteorological novice.

From the beginning, therefore, Exner set out on a new path, the theoretical development of synoptic meteorology which appeared to him to hold the chief problem of all meteorology—the prediction or, indeed, the precalculation of future weather. In his first works he made the attempt, but little satisfactory, to calculate future pressure distribution from given or present distribution. The fruitful combination with Margules's line of thought resulted when he began to take into consideration temperature conditions and temperature changes.

Doctor Exner carried on a life-long struggle with the problem of the origin, movement, and transformation of the cyclone, and the fact that in this he often changed the basic conception is proof of the difficulty and ambiguity of that problem. Of Exner's work in the field of dynamic meteorology it can be said that the chief advance relative to Margules's work lies in the fact that the former consistently attempted to dovetail the results of theoretical speculation in to the practice of synoptic meteorology. In this he was like Bjerknes, although not always in agreement with that leader in theory.

A summarization of acquired knowledge was given by Exner in his *Lehrbuch der dynamischen Meteorologie*, and through this he became the teacher of the younger generation of meteorologists far beyond the limits of Germany. In addition to the dynamic problem he gave attention to meteorological optics, mainly for the reason that the *Lehrbuch der meteorologischen Optik* begun by Pernter had to be completed after that writer's death. In a very brief time, he familiarized himself with this new field and in this work attracted much interest to that long neglected subject.

It is not so well known that Exner was the first German investigator to recognize the significance of the correlation method not only in meteorology, but also in many fields of applied mathematics. The conviction that, in all probability, one could never obtain the basis for long-range prediction along the line first followed led him to approach the problem through correlation, and in this he showed the capability, not natural in a theorist, of handling an immense amount of data. His concern with such questions convinced him that in the handling of this problem of great practical importance the creation of an international institution for investigation is an unconditional necessity.

Although not a theorist of the strictest type, as Margules, he was, especially in his younger days, very averse to meteorological works that did not use differential equations. So, at first, he was not very kindly disposed toward climatology, but at the beginning of his correlation studies it became clear to him that the numerous tables published by Hann in the *Meteorologische Zeitschrift* were of value, to be sure, as data only.

After the death of Doctor Hann the work of coediting the *Meteorologische Zeitschrift* was assumed by Exner. This was an activity not in keeping with his nature and it did not give him very great pleasure. At that time the scope of the journal had to be limited for financial reasons, and the assistance given by numerous meteorologists in other countries was due in no small part to Exner's prestige in the professional world.

Soon after the close of the World War Doctor Exner was named on the International Meteorological Committee and on different commissions of that organization. He was given membership in the *Akademie der Wissenschaften* (Vienna), elected to honorary membership in the Royal Meteorological Society in 1925, and the *Preussische Akademie der Wissenschaften*. In 1922 the Berlin University proposed him as successor to Doctor

Hellmann in the direction of the *Preussisches Meteorologischen Institut*, but on account of his dislike for excessive administrative duties he remained director of the *Österreichische Zentralanstalt für Meteorologie und Geodynamik* and professor of *Physik der Erde* at the University of Vienna.

His life was rich—in labors, in results, in friends.—*Abstract from Meteorologische Zeitschrift, March, 1930, by W. W. Reed.*

Investigations of the "Vega," summer 1929, by Leonard R. Schneider.—In the *Vega* number of YMER, vols. 1 and 2, 1930, J. W. Sandström gives in an article "Den Svenska Ishavsexpeditionen, 1929," the first summary of the outstanding events and scientific results of the Swedish expedition which spent June, July, and August of the summer of 1929 in the Greenland and Barents seas collecting meteorological and hydrographical data. Eighteen pages of the article describe how the expedition was got under way and what was accomplished along various parts of the voyage. Another 11 pages describe some of the kinds of ice encountered and in this discussion explanations are given for some of the peculiar formations. The remaining 14 pages have to do mostly with the meteorological problems.

But by far, the most interesting and instructive parts of the article are the graphs which show the results of the meteorological investigations and the most outstanding of these deserve a word of explanation. One graph for a 20-year period from 1874 to 1894 shows that when the air temperature in February is warm at the west coast of Norway, the time for opening of work in April, in the Uppsala, Sweden, district, is comparatively early. When the temperature is cool in Norway, the opening of the season is several days later. In another investigation it is shown that a pressure difference of 20 millimeters between Iceland and the Azores may cause either of two distinct types of weather over Europe. The chief features of these are shown in the graphs of the four main weather types of Europe for the winter months December, January, and February during the years 1900 to 1910, and all these may be summarized by the statements which have appeared in the Meteorologishe Zeitschrift, November, 1926, but which are again given here. They are as follows:

1. Westerly wind at Lofoten between N. 50° W. and S. 70° W. gives a warm northern and a cold southern Europe.
2. North-northeasterly wind at Lofoten between N. 10° E. and N. 40° E. together with east-southeasterly wind at Lofoten between 40° E. and S. 80° E. give a cold north and a warm south Europe.
3. South wind at Lofoten between S. 30° E. and S. 40° W. gives a cold Europe and a warm Atlantic.
4. East-northeasterly wind at Lofoten between N. 50° E. and N. 80° E. gives a warm Europe and cold Atlantic.

A graph of especial significance shows the sea water surface temperatures. By drawing lines across the number of meridians which represent the temperatures of the water, the author has been able to show in graphic form the temperature for each observation. Temperature above zero appear to the right and those below zero appear to the left of the line marking the course of the vessel. Although the Gulf Stream was crossed in all four times, the increased warmth due to the lateness of the season during the last crossing from the 30th to the 24th of August is striking, the temperatures being perhaps more than a degree warmer, though the course lay farther north. Still another graph shows the vertical water temperatures to a depth of 100 meters. With a careful examination of this full page graph one is able to find his way about, but it appears as if too much has been crowded onto one page to make it have a very great significance. An enlarged graph of the July 4 to the 9 crossing is however, quite clear and in this the Gulf Stream's western limit is plainly at 0° longitude and 72° N. latitude, the water being warmest at 14° E. longitude, and 70° N. latitude with temperature of 9° C. The graph of the wind direction and force, cloudiness, air temperature, precipitation, and days with fog, also puts too much information onto one map, still, the facts are there for those who are interested in digging them out. In all, 17 graphs and 25 photographs, some of which are interesting, are included in the article.

Captain Corneliussen, skipper of the expedition's vessel, says about the weather of the region, the result of 25 years' experience in Arctic seas: "When there is fine weather in the Arctic Sea there is bad weather in northern Norway, and vise versa." The author explains this by saying that when the warm Gulf Stream lies near Norway, the ascending currents over it give rise to rain and cloudy weather, but when the edge of the pack ice is farther west and the Gulf Stream is able to spread farther westward, then the region of rainy weather is farther westward and the Norway coast region becomes a region of descending air, hence fine weather prevails there. In a somewhat similar manner the author explains the cold European winter of 1928–9. In this case the heated air rose over the exceptionally warm Gulf Stream, spread out at high levels, and then descended over the northern part of the continent, the descending air giving clear skies and consequently cold nights to bring about a general lowering of the temperature.

As a summarizing statement the reviewer agrees with Mr. Sandström that more numerous and even more complete investigations of the Gulf Stream need to be carried out before definite conclusions relating to the problems of forecasting the weather of Europe can be settled, but the reviewer is led to ask the question, why not carry on the investigations nearer the source of the Gulf Stream?

Geological climates,[1] *by G. C. Simpson, C. B., F. R. S.*—The meeting of the Royal Society on March 27 was devoted to a discussion of the subject of geological climates, which brought out several points of great interest, and showed that the conflict of view, though still considerable, is less direct than it was some years ago. In opening the discussion, Dr. G. C. Simpson defined the problem from the point of view of a meteorologist, and laid down some fundamental principles with which all reconstructions of past climates must conform. He pointed out that the earth being approximately a sphere rotating on an axis inclined at an angle of about 66½° to the plane of the ecliptic, there must always have been climatic zones in which the mean annual temperature decreased from the equator to the poles, and there must always have been summer and winter.

Doctor Simpson then passed to the conditions existing at present, and showed that in spite of the great differences in the land and sea distribution of the two hemispheres, the mean annual temperatures of corresponding latitudes between the Equator and 70° nowhere differ by more than 3° C. From this he drew the conclusions that the mean temperature in any latitude is almost entirely independent of the distribution of land and water, and that the mean temperature of corresponding latitudes is always the same in both hemispheres. Hence it is impossible to explain great changes of climate in geological periods by means of changes

[1] Reprinted from "Nature," London, Apr. 5, 1930.

in the distribution of land and sea. The reason is that the gradient of temperature from Equator to Poles is controlled by the strength of the atmospheric circulation; an increase of the gradient is automatically followed by a strengthening of the circulation, and more heat is carried from the equatorial to the polar regions until the balance is restored. The supposition that large ice sheets could exist at sea level in the Tropics, while tropical conditions prevailed in middle latitudes of the northern hemisphere, is quite untenable. The only way in which major climatic changes could be brought about was by changes of solar radiation, and these had more effect on the cloudiness and precipitation than on the temperature. Extensive changes of mean annual temperature could only be brought about by movements of the crust relative to the poles, in the manner described by Wegener.

The subsequent discussion turned mainly on two points, the value of fossil plants and animals as indices of past climates, and the power of changes in the distribution of land and sea to modify the zones of temperature and introduce major climatic variations. Prof. A. C. Seward said that the climatic value of fossil floras has been greatly overestimated in the past, and there is now no justification for speaking of the climate of the earth as having been uniform or of high northern latitudes as having been tropical. It is not possible to infer the climate from a study of extinct genera or even species, because to-day allied species often live under quite different climatic conditions. Moreover, in the course of ages, plants may have altered their constitution as they passed from youth to senility. New plant types frequently originate in Arctic regions and spread southward, while in high latitudes they are driven out by the competition of later types, but this does not necessarily imply a change of climate. The vegetation of past ages was more uniform than that of to-day, but the uniformity has often been exaggerated, because the early floras consisted exclusively of gymnosperms, which resemble each other much more closely than do flowering plants. There is no justification for the assumption that the vegetation of the coal measures was tropical; on the other hand, the presence of glaciers does not necessarily imply temperatures at freezing point, for glaciers in New Zealand still end among vegetation of subtropical aspect.

Prof. J. W. Gregory illustrated another difficulty in the interpretation of fossil floras by showing how a coal bed may be in process of formation in Jan Mayen at present, the material being supplied by timber drifted from Siberia.

Sir Peter Mitchell agreed with Professor Seward that the climatic value of fossils has been overestimated, since animals have power to adapt themselves to changing climatic conditions. He added that for animal life the range of temperature is more important than the annual mean, and the annual range is closely dependent on the distribution of land and sea.

These modifications of the former claims of palaeontologists concerning past climates represent a great advance toward the meteorological view of the permanence of climatic zones, put forward by Doctor Simpson. The gap is not entirely bridged, however, for several speakers expressed the opinion that while there must always have been zones of temperature, Doctor Simpson has underestimated the possible effects of changes in the distribution of land and sea. Professor Gregory referred to a dictum by Lord Kelvin, that if the greater part of Europe, Asia, and North America were submerged beneath the sea, the Arctic Ocean would be free of ice, and an island at the north pole would have a mild climate. Dr. C. E. P. Brooks referred to investigations by Professor Kerner and himself which led to the same conclusion, and described the transfer of heat by ocean currents, especially in the Atlantic. He pointed out that the North Atlantic between 30° N. and the Arctic Circle is, on the average, about 5° C. warmer than the South Atlantic between 30° S. and the Antarctic Circle. This difference is almost entirely due to the fact that two-thirds of the warm equatorial water is carried into the North Atlantic by the Gulf Stream and Antilles Current. In many of the geological periods the distribution of land and sea, according to the usual palaeogeographical reconstructions, was such that the whole of the warm equatorial water was diverted into the northern hemisphere, and he argued that under such conditions the oceans of the northern hemisphere must have been much warmer than those of the southern hemisphere, and the thermal equator must have been well to the north of the geographical equator. Finally, Dr. C. Tate Regan described the distribution of fresh water and marine fishes during the Cretaceous and Eocene, which does not fit in with the drift of the continents as inferred by Wegener.

The general result of the discussion may be summed up by saying that the geological changes of climate have not been so great as was at one time supposed; but there is not yet any agreement as to whether they were small enough to be accounted for by ordinary agencies, or whether they were on a sufficient scale to necessitate an appeal to movements of the continents relative to the poles.

Solar eclipse April 28, 1930, at Havre, Mont., by FRANK A. MATH.—The eclipse of the sun forecast by astronomers for April 28, 1930, was distinctly visible at Havre, Mont. Under a bright, clear sky with only a few strato cumulus clouds near the horizon and a few cirrus in the zenith from 9:40 a. m. the first contact appeared on the sun about 11:05 a. m. The observations were made by naked eye through smoked glass or old negatives of film. The sun was steadily darkened until 12:40 p. m., when only a tiny crescent was observed through the glass. It was estimated that about 95 per cent of the sun was shut from view. For 10 or 15 minutes during the darkest part of the eclipse a pale, weird, steel-blue light was seen casting peculiar shadows with needlelike or woolly edges. A faint corona appeared around the sun. The cirrus clouds near the zenith turned a blue color. Birds went to roost. After 12:45 p. m. the sun began to brighten again. The eclipse was diminishing. The last contact on the sun was seen at 1:58 p. m.

The meteorological aspects of the eclipse were the shutting off of sunlight. The station sunshine recorder stopped registration at 11:52 a. m. and continued off until 1:24 p. m. The temperature, which had risen 4° to 5° steadily from 7 a. m., reached 58.8° at 11:35 a. m., when it began to gradually fall to 55.9° at 12:40 p. m., a drop of 2.9° in 65 minutes, an unusual occurrence at that hour under a clear sky. The sensitive effect of the temperature fall was very noticeable, as we should normally have had a rise of about 5° during that interval. Most persons in this city believed that the fall was 10° or 20°. They were disappointed to learn that the thermometer readings showed only 2.9°.

A smoked glass was placed over the theodolite lens and readings taken of the sun during the eclipse. The readings showed that the sun moved in azimuth from 150° to 202°, with zero setting on north. At Havre, Mont., true solar noon on April 28 occurs at 12:16 p. m., one-hundred and fifth meridian standard time, at which moment the altitude of the sun read 55.5° and the azimuth 180°.

Severe drought at Washington, D. C., April–May, 1930.—During the period April 18–May 14, 1930, no measurable rain fell at Washington, D. C. The longest drought hitherto experienced was that of September 30–October 26, 1924, or a single day longer than the first-mentioned. October, 1924, was exceptionally dry in the eastern half of the country; in some sections it was the driest month of that name for 100 years, the single exception being Florida where abundant rains fell.

The drought under discussion was one of the most severe spring droughts ever experienced. As shown by the Weekly Weather and Crop Bulletin of May 6, 1930, the month of April as a whole was exceptionally dry in the Gulf States, the Ohio Valley and Tennessee, and in the Atlantic States north of Georgia.

The visible cause both of the 1924 fall drought and the 1930 spring drought was the same in the larger features, viz, the predominance of anticyclones that descended from higher latitude and the consequent blocking of the eastward movement of cyclonic storms having their origin westward over the Plateau and Rocky Mountain regions. This effect was augmented by the anticyclonic conditions over the western Atlantic which spread to the westward over the southeastern States. In the 1924 drought not a single cyclonic storm crossed the Lake region and passed down the St. Lawrence Valley, but in the 1930 drought several cyclonic storms passed to the eastward over the St. Lawrence Valley; the rainfall from them was, however, light and spotted in distribution. Thus Baltimore, Md., only 40 miles east-northeast of Washington, received showers on April 21, 1929, and May 3, aggregating 0.16 inches, and Richmond, Va., about 110 miles south, received two showers totaling but 0.10 inch. The drought was broken on May 14 by general rains over the whole of the droughty region. Curiously enough, the direct cause of the breaking of the drought was an active anticyclone whose front had reached Manitoba, just north of Lake Winnipeg, on May 12. This anticyclone caused a rather vigorous cyclone, centered on the morning of the 12th over the valley of the Red River of the North, to change its course to the eastward and eventually to move across Lake Michigan, giving off a secondary over the upper Ohio Valley that produced general rains in the droughty regions.

Study of this and previous droughts leads to the conclusion that there is a definite rain shadow east of the Appalachians when rain-producing storms come from the west and pass down the St. Lawrence Valley—*A. J. H.*

Meteorological summary for Chile, March, 1930 (by J. Bustos Navarrete, Observatorio del Salto, Santiago, Chile).—With March there came increased activity in the atmospheric circulation over the Pacific Ocean; this was accompanied by a marked increase in rainfall in the south. Mean temperatures were rather high in the central zone of Chile.

The most important anticyclones were charted during the following periods: 3d–4th, 11th–13th, and 17th–20th. All of these HIGHS moved from southern Chile toward Argentina.

The depressions causing unsettled weather and rains in the southern area were mapped during the following periods: 6th–7th, 9th–12th, 13th–14th, and 26th–28th. In all periods the path was across the extreme southern region.—*Translated by W. W. R.*

BIBLIOGRAPHY

C. Fitzhugh Talman, in Charge of Library

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Ångström, Anders.
Measurement and registration of the outgoing effective temperature radiation. Stockholm. 1929. 6 p. 22 cm. (Arkiv. för mat., astron. och fysik. Bd. 22 B. N:o 1.)
Statistics and meteorology. p. 228–234. 24½ cm.

Baur, Franz.
Das Klima der bisher erforschten Teile der Arktis. p. 77–89: 110–120. figs. plates (fold.) 28 cm. (Sonderab.: Arktis. Jahrg. 1929. H. 3–4.)

Bennett, A. B., *jr.*
Forecasting the weather. [Washington, D. C.] [1918.] 16 p. figs. 23 cm.

Bignell, L. G. E.
Does rainfall increase in oil fields? v. p. illus. 34½ cm. (Extr.: Oil & gas journ. Oct. 31, 1929.)

Conference of empire meteorologists. Agric. sec.
British agricultural meteorological scheme. Observers' handbook. London. 1929. 34 p. figs. plates (part fold.) 25 cm.
Report. 1. 1929. London. 1929. 16 p. 25 cm.

Eriksson, J. V.
Den kemiska denudationen i Sverige. La dénudation chimique en Suède. Stockholm. 1929. 96 p. figs. 31½ cm. (Med. Stat. met.-hydrog. anstalt. Bd. 5. N: o 3.)

Fujiwhara, S.
On the behavior of lines of discontinuity, cyclones and typhoons in the vicinty of Japan. p. 120–131. figs. 26 cm. Repr.: Geophys. mag., v. 2, no. 2, 1929.)

Galtsoff, Paul S.
Destruction of oyster bottoms in Mobile Bay by the flood of 1929. Washington. 1930. p. 741–758. fig. plates (fold.) 23½ cm. (Appen. 11 to report U. S. comm. fish. 1929.)

Glasspoole, John.
Extremes of rainfall over the British Isles. 9 p. diagr. 24½ cm. (Official circular Brit. waterworks assoc. No. 81, 1929.)

Jaumotte, J.
Sur le mouvement des masses d'air dans l'atmosphère. Bruxelles. 1930. p. 1018–1055. figs. 25½ cm. (Acad. roy. Belg: Extr.: bull. cl. sci. Séance du 7 déc. 1929. 5e sér. T. 15.)

Kopp, W.
Wetterkarte für den meteorologischen Unterricht. Berlin. n. d. 26 p. illus. 30 cm.

McEachron, K. B.
Thyrite, a new material for lightning arresters. 5 p. 61½ cm. (Paper read before A. I. E. E. mid-winter convention, New York City, Jan. 27–31, 1930.)

Meinardus, Wilhelm.
Die räumliche und zeitliche Verteilung der Beleuchtung in den Polargebieten. 6 p. plates (part fold.) 27½ cm. (Sonderab.: Geogr. Anzeiger. Jahrg. 1930. H. 1.)

Mercanton, P. L.
La température du sol à Lausanne (Champ-de-l'Air) à un mètre de profondeur, de 1898 à 1918. Lausanne. 1929. P. 33–37. fig. 24½ cm. (Bull. de la soc. vaud. des sci. nat. v. 57 no. 223. 1929.)

National research council. Div. geol. & geogr.
Report of the committee on submarine configuration and oceanic circulation. April 27, 1929. (Appendix E of annual report of division.) 2, 50 p. 28 cm.

Schmidt, Wilhelm.
Meteorologische Feldversuche über Frostabwehrmittel. Wien. 1929. 43 p. figs. 30½ cm. (Anhang zu den Jahrb. der Zentralanst. für Met. und Geod. Jahrg. 1927. Pub. Nr. 135.)

Theaman, John R.
Book of excessive rainfall records. Indianapolis. 1929. unp. 21 cm.